

rents, can remove only the finest ingredients; and as to large boulders, it would seem that only the most violent waves and mountain streams can tear them up, and roll them along.

Oceanic currents have the power greatly to modify the situation of the materials brought to the sea by rivers and tides, and to spread them over surfaces of great extent.

Thus the waters of the Amazon, still retaining fine sediment, are found on the surface of the ocean 300 miles from the coast, where they are met by the equatorial current, which runs there at the rate of four miles per hour. Thus are these waters carried northerly along the coast of Guiana, where an extensive deposit of mud has been formed, which extends an unknown distance into the ocean. In like manner the muddy waters of the Orinoco and other rivers are swept northerly. Scoresby counted 500 icebergs starting from the frozen regions, at one time, for the south. Doubtless a great part of the Banks of Newfoundland is produced by the deposition of the materials from these bergs.

Of the above agents of erosion the ocean has, without doubt, been by far the most potent. It must be borne in mind, that our present continents, certainly North America, have been several times submerged beneath the ocean, and again elevated above it by slow vertical movements; so that every part of these countries has been again and again subjected to the long-continued action of the waves and currents; in other words, every portion of the surface has been repeatedly the shore of the ocean, against which its waves, tides, and currents, have impinged as fiercely as they now do. During the Silurian and Devonian periods the surface, composed of rocks of that age, must have been beneath the ocean. But during the Carboniferous period, large portions at least must have been above the waters, to furnish the gigantic vegetation which was converted into coal. Subsequently that same surface, in some countries certainly, must have gone down to receive the thick marine beds of the Oolite and Chalk. During the Tertiary period, there appears to have been sometimes an alternation of salt and fresh water deposits. But subsequently it seems the whole of our western continent was submerged, and then again raised essentially to its present height.

#### AMOUNT OF DENUDATION

The great amount of denudation that has been the result of these several agencies may be learned by the following facts: